EXPANDER LOCKING PLIER

Note: This application is based on my provisional patent application filed on 9/16/2002 with application number 60/410,440.

REFERENCE CITED

U. S. PATENT DOCUMENTS

2,590,031	3/1952	Christian Petersen
2,641,149	6/1953	Christian Petersen
3,585,704	6/1971	J. A. Schroeder
4,305,575	12/1981	Dale L. Bardes
4,386,542	6/1983	Louis R. Verna
4,477,937	10/1984	James Costello
4,730,524	3/1988	Christian Petersen
5,022,290	6/1991	Thomas F. Duffy
5,305,669	4/1994	Gary A. Kimbro

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a class of locking pliers, or vise-grips in general, and more particularly to expander locking plier with easily adjustable clamping force. The invention is capable of clamping one or two workpieces against the internal surfaces of a tube, a fixture or another workpiece with adjustable clamping force. It is also capable to expand two portions of a workpiece or two workpieces apart by turning the rear adjustment screw mounted on the fixed arm. The screw and thread design of the jaws enable the adjustment of the invention to suit variable internal sizes of fixture or workpieces in concern.

2. Description of the Related Art

A conventional locking plier or vise-grip generally comprises a fixed arm with clamping jaw, a movable arm attached with clamping jaw and a self-locking and quick release mechanism built into the movable arm. To serve various applications, there are many different designs of the clamping jaws for locking pliers in the field, such as: cutter attachment jaws, U.S. Patent No. 2,590,031; C-shape jaws used in the Gripping Tool, U.S. Pat. No. 2,641,149; cylindrical jaws used in tube and shaft clamping, U.S. Pat. No. 3,585,704 and 5,305,669; L-shape jaws used in Toe-nailing Clamping Tool, U.S. Pat. No. 4,305,575; very large gripping jaws, U.S. Pat. No. 4,386,542; chain clamping jaws, U.S. Pat. No. 4,477,937; long nose jaws, U.S. Pat. No. 4,730,524; and adjustable locking jaws, U.S. Pat. No. 5,022,290; etc. However, almost all of these designs are used to clamp externally on workpieces, or more accurately speaking, the clamping force is applied from outside towards the inside of the workpieces. Although not so common in the field, there are situations where clamping from the outside of a workpiece is not possible. Or there are applications that require the workpiece or workpieces being clamped inside a tube, or between two internal surfaces of a workpiece or fixture. Besides these static operations, there may be a situation that requires a means to expand two portions of a workpiece, or to push two workpieces apart with desired amount of force. It is the intention of the present invention to provide a handy tool to serve these purposes. Another intention is to enable the adjustment of the clamping force on the workpiece by turning the rear adjustment screw. Further intention of the present invention is to provide a convenient means to increase the expanding force on the workpieces by inserting a metal rod or any suitable screwdriver into the hole equipped on the rear adjustment screw to act as a handle to increase the turning torque. Yet another intention of the invention is to provide a simple means to adjust the workable size of the pliers. Such a simple means is the screw and thread design mounted to the jaws attached to the fixed arm and the movable arm.

SUMMARY OF THE INVENTION

The present invention comprises a fixed arm attached with a J-shape clamping arm and adjustable jaw at one end and with a rear adjustment screw at the other end, a movable arm with self-locking and quick release mechanism, and an adjustable moving jaw connecting the fixed arm and the movable arm by pivots. Similar to the design of a conventional locking plier, the crossed section of the fixed arm is U-shape at one end and cylindrical shape at the other end. At the U-shape end, the straight end of a L-shape metal plate is inserted and fixed with two rivets and the curved end of the L-shape metal plate is protruded outside the fixed arm. The J-shape clamping arm is made of two J-shape metal plates spaced apart by a rectangular metal block welded at the smaller end. The larger end of the J-shape clamping arm is riveted onto the protruded curved end of the L-shape metal plate. With such a construction, the J-shape clamping arm is hollow in the middle so that the adjustable moving jaw can be fed through it. The cylindrical end of the fixed arm is threaded inside to feed the rear adjustment screw which is an elongated thumb screw with a cylindrical hole drilled at right angle to the screw axis.

The movable arm is similar in design as a conventional locking plier. At one end the adjustable moving jaw is pivoted and at the other end the elongated release lever is attached. In between but closer to the end with the adjustable moving jaw, a toggle-like member is pivoted. The free end of this toggle-like member is inserted into the inside of the fixed arm and touching the inner end of the rear adjustment screw. The movable arm is connected to the fixed arm through the adjustable moving jaw with pivots and spring. The adjustable moving jaw is fed through the hollow portion in the middle of the J-shape clamping arm. The adjustable moving jaw is equipped with a long screw inserted into a threaded hole so that the length of the protrusion of the screw can be adjusted. Through the rectangular metal block a shorter screw is inserted to form the clamping jaw of the J-shape clamping arm. It is the crossed relationship between the adjustable moving jaw and the J-shape clamping arm that enables the expanding action when the movable arm is pressed against the fixed arm. To adjust for the clamping size and clamping force, the rear adjustment screw is turned clockwise or counterclockwise so that the inner end of the screw will change the position of the toggle-like member and hence the angular position

of the adjustable moving jaw. If stronger clamping force is needed, a metal rod, a screw driver or any tool with a rod of the right size can be inserted into the cylindrical hole on the rear adjustment screw to turn it with the larger torque required.

The expanding action of the present invention makes internal clamping possible. Workpieces can be clamped between two opposite surfaces of a fixture or another workpiece, or clamped inside a tube. Another useful application of the present invention is to expand two workpieces or two portions of a workpiece apart with desired amount of force. The effective clamping size of the invention is adjustable by the screw and thread design of the adjustable moving jaw and the jaw attached to the J-shape clamping arm.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of the invention;

FIG. 2 is a perspective view of the front part of the invention showing the clamping jaws; and

FIG. 3 is an exploded side view of the invention with the clamping arms at the open position.

DETAILED DESCRIPTION OF THE INVENTION

With the help of the drawings and the detail description below, the features of the present invention will be apparent and fully understandable.

Referring to FIG. 1, the expander locking plier comprises a fixed arm **1**, a movable arm **2** with self-locking and quick release mechanism, a J-shape clamping arm **3** with adjustable jaw **4**, an adjustable moving jaw **5** and a rear adjustment screw **6**. Resembling the fixed handle of a conventional locking plier without the clamping jaw, the crossed section of fixed arm **1** is U-shape at one end **7** and cylindrical shape at the other end **8** which is threaded inside. The straight portion of a L-shape metal plate **9** is fixed to end **7** with two rivets. The J-shape clamping arm **3** is made of two J-shape metal plates welded

together with a rectangular metal block **10** at the smaller ends. The bigger end of the J-shape clamping arm **3** is riveted to the curved end of the L-shape metal plate **9**. Hence the J-shape clamping arm **3** is hollow in the middle part so that the adjustable moving jaw **5** can be fed through it and free to move inside this part as shown in FIG. 2. Adjustable jaw **4** is a short screw feeding through the threaded hole of the rectangular metal block **10** so that the protrusion of the jaw can be adjusted as required. At the cylindrical end **8** of the fixed arm **1**, the rear adjustment screw **6** is screwed into the internal thread of end **8**. This screw **6** is used to adjust the clamping size between the clamping jaws and to adjust the clamping force also. At the outside end of screw **6**, a cylindrical hole **19** is drilled at right angle to the axis of the screw for inserting a metal rod or any tool with a metal rod of the right size such as a screwdriver to increase the clamping force by applying a larger torque.

With reference to FIG. 1 and FIG. 2, the adjustable moving jaw **5** is pivoted to the U-shape end **7** of fixed arm **1** with pivot **12**. A tensional coil spring **17** is hooked to a hole on the adjustable moving jaw **5**. The other end of spring **17** is hooked to an ear inside the middle of the fixed arm **1**. Spring **17** is used to provide the pulling force on the adjustable moving jaw **5** for quick releasing and opening. At the outside end of the adjustable moving jaw **5**, a threaded hole is provided to insert the screw-like jaw **20** which is used to adjust the effective clamping gap between the clamping jaws **4** and **20**. The adjustable moving jaw **5** is fed through the hollow middle part of the J-shape clamping arm **3** so that a crossed relationship between the J-shape clamping arm **3** and the adjustable moving jaw **5** is established. This crossed relationship provides the expanding action of the two jaws **4** and **20** when the movable arm **2** is pressed towards the fixed arm **1**. With such a design, the present invention is capable of expanding two workpieces, or two portions of a workpiece apart with an adjustable force. It is also capable of clamping two workpieces internally inside a tube, or against two internal surfaces of a fixture or another workpiece. The effective clamping size of the invention is adjustable by the rear adjustment screw **6** and the screw and thread design of clamping jaws **4** and **20**.

Referring to FIG. 1 and FIG. 3, movable arm **2** is similar in design and function as the movable handle of a conventional locking plier. It is connected to the fixed arm **1**

through the adjustable moving jaw **5** with pivots **11** and **12**. A toggle-like member **13** is pivoted to the movable arm **2** next to pivot **11** with pivot **15**, the opposite end **16** is inserted to the cylindrical end **8** of the fixed arm **1** touching the inside end of the rear adjustment screw **6**. Toggle-like member **13** is used to provide the pushing and locking action and hence the clamping force to the adjustable moving jaw **5** during clamping operation. An elongated release lever **14** is pivoted to the free end of the movable arm **2** with the inner tip touching the notch **18** of the toggle-like member **13**. While the present invention is in clamping position, that is, the pivot **11**, pivot **15** and the end **16** of toggle-like member **13** are in a straight line, pressing the elongated release lever **14** will push the notch of the toggle-like member **13** to break such an in-line relationship so that the clamping force exerted on the adjustable moving jaw **5** is released instantly, and the adjustable moving jaw **5** is pulled away immediately from the workpiece by the pulling action of the spring **17**. Hence the workpiece (workpieces) is (are) released instantly.